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CONTENTS:

SOME NEW FEATURES IN UINTACRINUS, ... *H. T. Martin.*

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KANSAS UNIVERSITY SCIENCE BULLETIN.

VOL. IV, No. 6. MARCH, 1907. WHOLE SERIES. VOL XIV, No 6.

SOME NEW FEATURES IN UINTACRINUS.

BY H. T. MARTIN.

Contribution from the Zoological Laboratory.

With plates IX and X.

THE morphological study of *Uintacrinus* by Mr. F. A. Bather, of the British Museum,[1] closely followed by the more elaborate memoir on this interesting crinoid by Mr. Frank Springer,[2] in which he so ably describes its relationships and structure, seemed to cover all the points that possibly could be brought to light on the subject. Nevertheless it is the intention in this paper to try to present some new features of the internal construction of the nerve grooves. These were first found on the inner surface of a single calyx in the writer's collection, and their presence confirmed by the examination of several specimens in the University collection.

When examining specimen No. 1, I found that in this particular instance the thin lenticular mass forming the plate, or slab, had been split by weathering and frost, from which I concluded that by splitting other plates some interesting features might possibly be shown. Accordingly a number of small weathered plates were experimented upon, and these amply repaid the effort, duplicating the appearances found in the first one, and strengthening the evidence upon several points shown on specimen No. 1.

Specimen No. 1 shows the inner floor of a nearly complete calyx (pl. IX, fig. 1) inverted and lying on its dorsal surface, thus exposing, for the first time, to my knowledge, the cup

1. On *Uintacrinus:* A Morphological Study. Proc. Zool. Soc. Lond., vol. 1895, pp. 974-1004.

2. *Uintacrinus;* its Structure and Relations. Mem. Mus. Comp. Zool. Harvard Coll., vol. XXV, No. 1.

in this position. Hill[3] and Bather[4] both tried to obtain some idea of the internal construction by dissecting, and removing the plates, but with no success; while Bather says of the calyx, "the dorsal cup alone is known to us."

By referring to plate IX, figure 1, in which specimen No. 1 is shown natural size, it will be seen that the calyx was very little distorted by the flattening out, and that the base is nearly in the center of the specimen as preserved; and although incomplete it shows a base, dicyclic in form, composed of five basals, five very small, irregular infrabasals, and a centrale. Enough of the cup is preserved to show plainly the structure and course of the nerve strands from the outer margins of the basals to the second secundibrachs.

There is a well-defined grooved ring, pentagonal in shape, which joins together the nerve grooves that radiate from the basals at the center of the radials. (Pl. X, fig. 2.)

Specimen No. 1, plate IX, is the most instructive one examined, and shows the internal part of the calyx. This has a dicyclic base, with small, irregular infrabasals.

There are seven distinct but very small nerve grooves, three from each right and left half of the two adjoining basals, and a middle groove, a little the widest, which is in a direct line with each interbasal suture. A single groove, commencing at the basi-interradial suture, forking at the level of the basals, joins the set of grooves at the basi-radial suture, from where they all converge to a center in the middle of the radial plate, when they join the corners of the pentagonal ring commisure encircling the basals. The junctions of the radials are also connected at the sutures by four small grooves, two on each side of the ring commisure. The nerves leading up into the arms, as far as the primabrachs, are carried in four grooves (see pl. IX, fig. 2), which are encircled in shallow diamond-shaped pits, radiating from the pentagonal ring at the center of the radials. The pits containing the nerve cords must have been a receptacle for a bunch of muscular ligaments, having its main points of attachment at the center of the plates, the nerve cords follow-

3. Kan. Univ. Quart. 1894, vol. III, No. 1.

4. A Morphological Study of *Uintacrinus*, Proc. Zool. Soc. Lond., vol. 1895, p. 979.

ing the same line. The depressions are connected with each other by a narrow canal at the center of the plate it traverses.

The radial diameter of the proximal depression exceeds the transverse diameter by half its length, while exactly the opposite occurs at the point where the pinnules branch out (see pl. IX, fig. 3), until at the sixth and seventh secundibrachs they appear only as deep, narrow, transverse grooves which extend clear across the arm plates. Each series of pinnules is supplied with a set of the nerve groove depressions, which branch out from the main arm grooves.

The specimen on plate IX, figure 4, shows some well-defined markings on the inner side of the plates of a portion of another cup. The lines occur in three or four small terraces, which conform very regularly to the shape of each plate, and must have been for the attachment of several layers of ligamentary muscular tissue, thus forming a much stronger, though no less flexible sutural articulation than has been heretofore supposed probably.

Bather[5] says: "If the base be dicyclic, the ring forms a commisure at the level of the centers of the basals; and from these points the cords again fork towards the adjacent infrabasals, where they join in another ring round the chambered organ."

Out of the six specimens I have examined, all of which are dicyclic, four show a perfect ring commisure at the level of the radials; the other two show it distinctly on three of the radials. I have traced a single nerve-cord groove clear from the basi-infrabasal sutures to the center of the basals, at which point they fork, sending out a prong towards the center of each of two adjoining radials. From the above evidences of the course of the nerve-groove system, which appears to be directly in opposition to the principle laid down in Lancaster's Zoology, it would seem that some alteration must be made in our ideas of the course of the nerve groove and situation of the ring commisure in dicyclic forms, at least in the case of *Uintacrinus*.

A diagram based upon the material examined, showing the

5. Lancaster's Zoology, part III, p. 194.

probable course of the nerve grooves, is shown on plate X, figure 1.

I here wish to thank the following for the interest shown and assistance given in the preparation of this paper: Mr. Frank Springer, for many valuable suggestions; Dr. C. E. McClung, for much assistance and for the fine photographs, all of which he kindly made; and Miss Nadene Nowlin, for the drawings.

PLATE I.

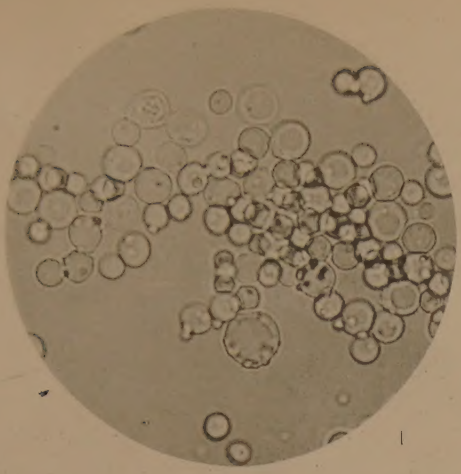
Saccharomyces anomalus grown in liquid media.

FIGURE 1.—The parent type from an old culture in wort.

FIGURE 2.—A new race of the same age grown in the same medium.

FIGURE 3.—A young culture of a new race grown in broth.

Plates I, II and III are magnified 1000 diameters; plate IV, 250 diameters. The yeasts represented in plate I were photographed unstained. Those in plate II were stained in an aqueous solution of neutral red, and the bacteria in plate III were stained with carbol fuchsin. Owing to shrinkage in staining, what were continuous filaments in the living culture of the bacteria often show as chains of disconnected elements in the photomicrograph (fig. 2, plate III). In all cases the new races and the corresponding parent races were stained alike and photographed with the same magnification. None of the photographs have been retouched in any way.



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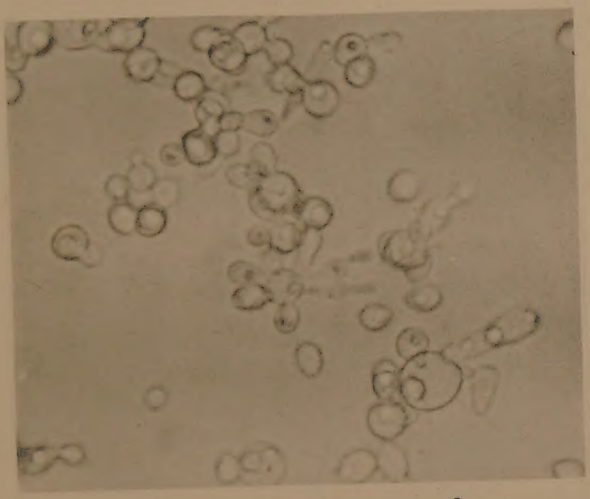

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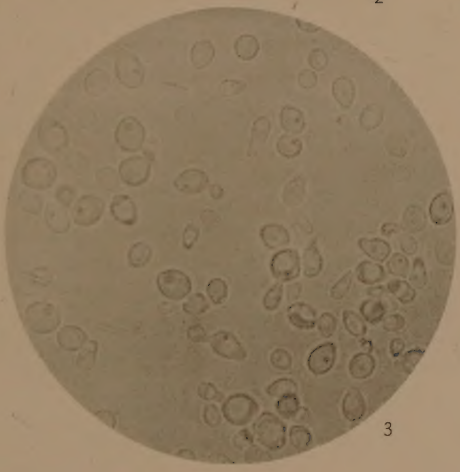


3

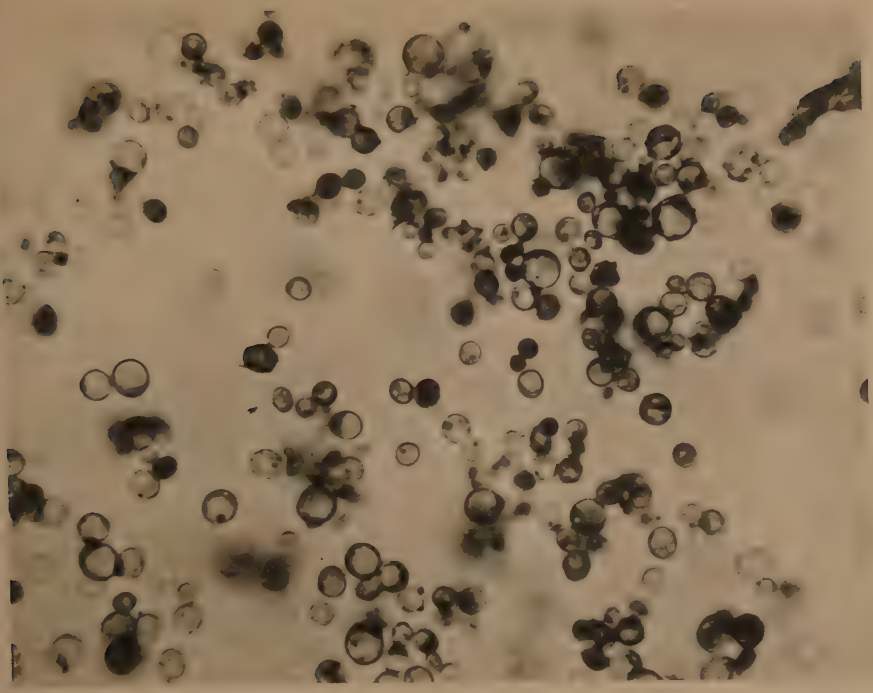
HELIOTYPE CO., BOSTON.

PLATE II.

Saccharomyces anomalus.

FIGURE 1.—The parent type after about ten days' growth on glucose agar.

FIGURE 2.—A new race grown on the same medium and under the same conditions as the parent. This new race had been originated two years and four months previously.



1

2

HELIOTYPE CO., BOSTON.

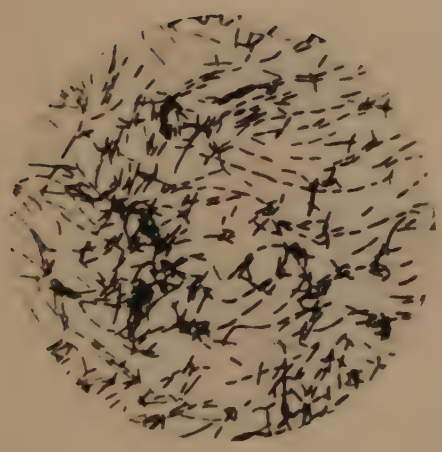
PLATE III.

Bacillus coli communis.

FIGURE 1.—Parent type from a one-day broth culture.

FIGURE 2.—New race A, grown under the same conditions.

1



2

HELIOTYPE CO., BOSTON.

PLATE IV.

Saccharomyces anomalus.

FIGURE 1.—Colonies of the parent type in glucose gelatin.

FIGURE 2.—Colonies of a new race grown under the same conditions. The new race colonies show a ragged outline, due to the outgrowth of elongated cells.

Bacillus coli communis.

FIGURE 3.—Colony of the parent type, grown in gelatin.

FIGURE 4.—A colony of the new race A, grown under like conditions.

PLATE IV.

Saccharomyces anomalus.

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FIGURE 2.—Colonies of a new race grown under the same conditions. The new race colonies show a ragged outline, due to the outgrowth of elongated cells.

Bacillus coli communis.

FIGURE 3.—Colony of the parent type, grown in gelatin.

FIGURE 4.—A colony of the new race A, grown under like conditions.

1

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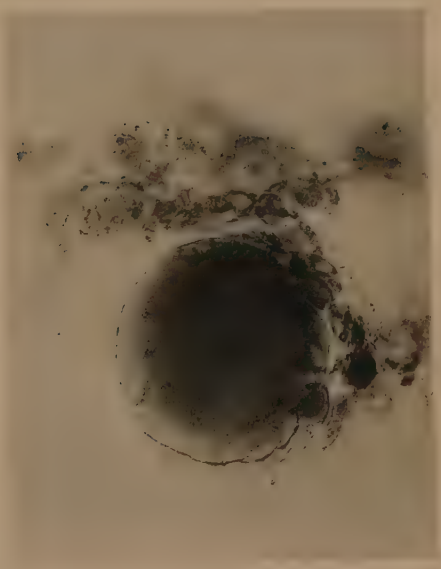


4

HELIOTYPE CO., BOSTON.

PLATE V.

PLATE V.

Dielasma schucherti. Page 148.

1.—Interior of the shell of a young specimen, 5 mm. in length, showing loop, foramen, etc. The loop should be more angular where it begins its curve. No. 59 of collection from Dozier, Tex.

1*a*, 1*g*, 1*h*, 1*i*, 1*j*.—Young specimens, showing some of the variations in form, the muscular impressions (elevations in casts) in the shell which later fill to form a sort of platform. Most of the figures are a trifle over natural size; 1*h* shows the beginning of the plications. Sometimes the shells attain a much larger size before showing the plications as in 1*l*. Specimens Nos. 32, 30, 29, 28, 31, respectively, from Whitehorse spring, Oklahoma.

1*b*.—Adult specimen, brachial aspect, showing biplication, crural and lemellar impressions.

1*c*.—Side view of same; 1*d* is the pedicle view, showing impression of dental lamellæ. No. 25, Whitehorse collection.

1*e*.—Another specimen from Dozier, younger than 1, showing loop still disconnected. There is a more acute angle, than shown in the drawing, where the loop first rolls outward from the supports. No. 125, Dozier collection.

1*f*.—An abnormal specimen of pedicle valve showing a tendency to develop more plications and strong sets of dental lamellæ. No. 24, Whitehorse collection.

1*k*.—Lateral view of robust specimen, still immature.

1*l*.—A figure of a half-grown individual. No. 27, Whitehorse collection.

1*m*.—A portion of a replaced shell in a mold, showing the punctæ. Very highly magnified. Under an ordinary lens they appear as the ordinary meshwork of *Dielasma*. No. 23, Whitehorse collection.

Aviculopecten vanvleeti. Page 159.

2.—A very large, poorly preserved specimen. Natural size. No. 13 Whitehorse collection.

2*a*.—A somewhat smaller specimen, showing the nature of the surface marks and one of the ears. The drawings of this species are poor and express very inadequately the surface characters of the species. They are like those of *A. occidentalis*, but with three to five large ribs, more pronounced than in that species. No. 10, Whitehorse collection.

2*b*.—Broken opposite valve of another specimen probably of this species. It is remarkable in being almost free from surface marks. No. 17, Whitehorse collection.

2*c*.—A slightly flattened valve of this species showing the opposite ear from that shown in 2*a*. The figure shows the ear a little too convex and the sinus below it too shallow, changing considerably the expression of the shell. No. 11, Whitehorse collection.

(OVER)

2*d*.—A small broken shell of this species, showing portions of both ears. No. 14, Whitehorse collection.

2*e*.—A portion of the lower right side of 2*a*, enlarged to show the nature of the surface ornamentation. No. 10, Whitehorse collection.

Aviculopecten oklahomaensis. Page 158.

3.—A rather small convex valve. The outline of the specimen is faulty, particularly the ear and anterior region. It shows, however, the fact that the ribs are all equal in size except those coming in by implantation. It differs somewhat in its umbonal region from the type figured on the following plate, and may possibly be a different species. No. 19, Whitehorse collection.

3*a*.—Flat valve, probably of this species, nearly complete, showing strong byssal sinus. No. 12, Whitehorse collection.

3*b*.—The mold of a valve somewhat larger than No. 3, showing the impressions, poorly, of the vaulted scales on the ears. No. 20, Whitehorse collec ion.

3*c*.—A young specimen of this species and a nearly perfect cast of the left valve. The anterior ear is shown a trifle too large, and the sinus below it a little too shallow, thus making the ear extend a little too far down the shell. Ventral outline more rounded than shown in the figure. No. 18, Whitehorse collection.

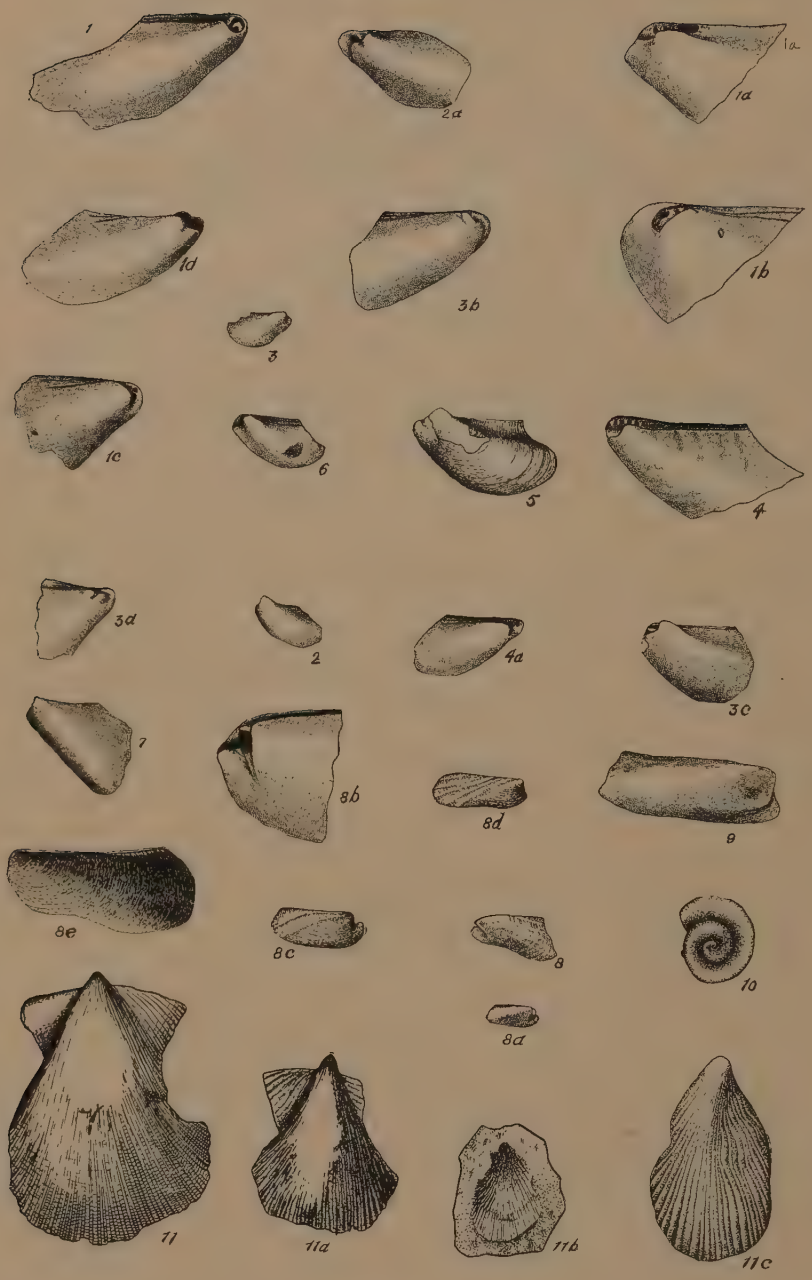
Solenomya sp. Page 150.

4.—View of right valve. One of the two specimens in the collection. No. 22, Whitehorse collection.

Serpula? sp. Page 148.

5.—A minute specimen shown in the mold of a shell. The length of the op of the specimen is little more than ½ mm. No. 126, Dozier collection.

PLATE VI.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11a
11b
11c

PLATE VI.

Cyrtodontarca ? gouldii. Page 152.

1–1*c*.—Views of valves. 1 and 1*c* are right valves, 1*a* and 1*b* are right valves, all showing nature of dentition, as best it can be shown, under the beaks of the casts. The specimens are tilted at various angles to show the teeth, which accounts for the variety of peculiar forms.

1*c*.—Appearance of right valve showing two lateral teeth. Nos. 69, 68, 52, 54, and 70, respectively, of Whitehorse collection.

2, 2*a*.—Specimens referred provisionally to this species, though they are probably distinct from it. 2*a* shows the dentition. Nos. 50 and 51, Whitehorse collection.

Cyrtodontarca ? parallelidentata. Page 153.

3–3*c*.—Four specimens of this species. No. 3 shows the general aspect of the cast of the shell, somewhat broken; 3*a* and 3*b*, two right valves enlarged, showing, poorly, the nature of the dentition; 3*c* is the left valve, showing the dentition much better. Enlarged. Whitehorse collection.

Cyrtodontarca ? multidentata. Page 153.

4, 4*a*.—Left and right valves, showing dentition. Enlarged. Nos. 55 and 56, Whitehorse collection.

Cyrtodontarca ? sp.

5.—A specimen, the dentition of which is not preserved, showing the nature of the surface markings. $\times 3/2$. No. 101, Whitehorse collection.

Cyrtodontarca ? sp.

6.—An incomplete specimen, dentition not shown. No. 55*a*, Whitehorse collection.

Myalina sp. Page 156.

7.—Fragment of valve, natural size. No. 74, Whitehorse collection.

Pleurophorus ? albequus. Page 160.

8.—Left valve of specimen, showing radiating ribs and a strong, more backward-curving ridge in the shell than normal, with correspondingly sharp beak. No. 42, Whitehorse collection.

8*a*.—Right valve of a young specimen, possibly of the variety *longus* of this species, showing lateral posterior hinge tooth. No. 41, Whitehorse collection.

8*b*.—Enlarged beak of left valve of cast, showing impression of hinge

(OVER)

teeth. The posterior of this specimen (not figured) has the lateral tooth parallel with the hinge strongly developed. No. 39, Whitehorse collection.

8*c*.—Right valve of a specimen, showing only two radiating ridges. No. 38, Whitehorse collection.

8*d*.—Squeeze from mold of right valve of specimen, with beak and hinge line missing, showing five ridges.

8*e*.—The mold of the above specimen, showing lamellar striæ in the sinus below the umbo and the impressions of the "granulations" below the beak. No. 58, Dozier collection.

Pleurophorus albequus longus. Page 162.

9.—Cast of right valve. Front and posterior end broken away. No. 40, Whitehorse collection.

Spirorbis sp. Page 148.

10.—View of cast of attached surface shown on cast of a shell. Greatly magnified. No. 44, Whitehorse collection.

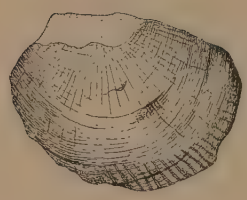
Aviculopecten oklahomaensis.

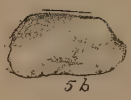
11.—A somewhat broken specimen of a left valve, about natural size. No. 21, Whitehorse collection.

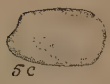
11*a*.—Another individual, probably compressed antero-posteriorly, making the beak appear narrower and sharper than it should. There is also a slight difference in the size of the ribs and the concentric markings are not brought out so strongly as they should be in the drawing. No. 16, Whitehorse collection.

11*b*.—Mold of a small specimen; 11*c* is a rough squeeze of the same enlarged, showing the undulating striæ sometimes found upon specimens of this species. No. 15, Whitehorse collection.

PLATE VII.







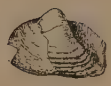


PLATE VII.

Pseudomonotis sp. Page 156.

1.—Portion of flat valve, natural size. No. 103, Whitehorse collection.

Conocardium oklahomaense. Page 151.

2.—Mold of a specimen, about natural size.

2*a*.—Squeeze of the same. No. 33, Whitehorse collection.

2*b*.—Drawing of a fragmentary specimen, greatly enlarged, to show the markings on the posterior of the shell. No. 35, Whitehorse collection.

2*c*.—Vertical view of a cast.

2*d*.—Lateral view of same. No. 36, Whitehorse collection.

2*e*.—Greatly enlarged portion of the mold of another specimen, to show the fine markings on the umbonal keel. No. 34, Whitehorse collection.

2*f*.—A portion of the mold of another specimen, enlarged, showing the larger longitudinal ridges on the posterior portion of the shell. No. 37, Whitehorse collection.

Edmondia rotunda. Page 150.

3.—Profile of cast, showing slit formerly occupied by the platform beneath the beak, characteristic of the genus. Enlarged. No. 75, Whitehorse collection.

3*a*.—Left valve of same, natural size.

3*b*.—Left valve of another specimen. No. 76, Whitehorse collection.

Edmondia cumminsi. Page 151.

4.—Cast of type specimen, natural size. No. 57, Dozier collection.

4*a*.—Another specimen, natural size. No. 104, Dozier collection.

Allorisma? albequus. Page 160.

5.—Cast of right valve, $\times 2/1$. No. 105, Whitehorse collection.

5*a*.—Cast of left valve, $\times 2/1$. No. 106, Whitehorse collection.

5*b*.—Cast of right valve, from Texas, $\times 2/1$. No. 55*a*, Dozier collection.

5*c*.—Cast of left valve, $\times 2/1$. No. 55, Dozier collection.

Schizodus? oklahomaensis. Page 157.

6.—Cast of valves, natural size. No. 46, Whitehorse collection.

Schizodus ovatus?. Page 157.

7.—Cast of left valve, imperfect in posterior outline, natural size. No. 8, Whitehorse collection.

(OVER)

7*a*.—Cast of right valve of another specimen, natural size. No. 7, Whitehorse collection.

7*b*.—Cast of left valve of a large specimen, poorly preserved, probably of this species, natural size. No. 6, Whitehorse collection.

Capulus sellardsi. Page 170.

8.—Cast of a large, rather narrow specimen, dorsal view, natural size. No. 4, Whithorse collection.

8*a*.—Same view of another individual, broad form, natural size. No. 2, Whitehorse collection.

8*b*.—Enlargement of surface detail from posterior, right part of 8*a*.

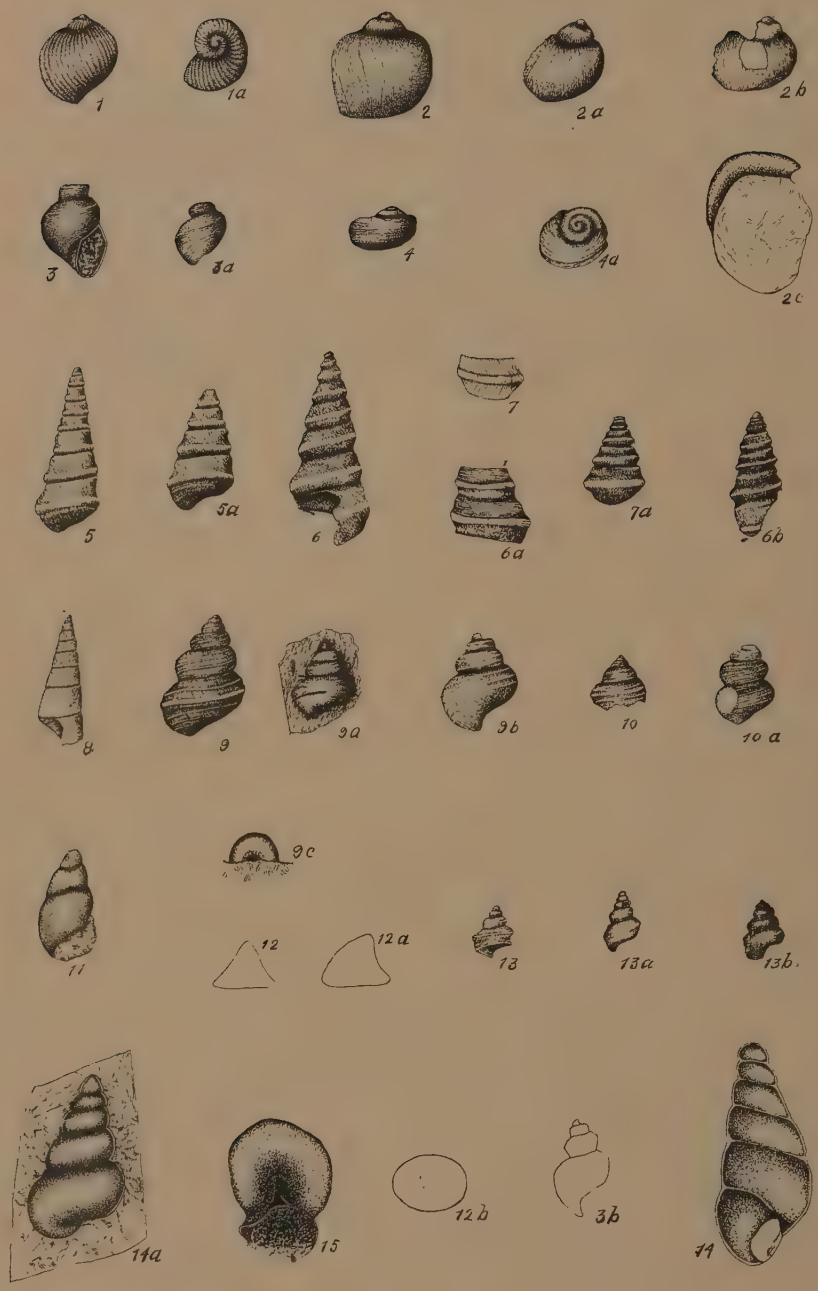
8*c*.—A young specimen of this species, natural size. No. 5, Whitehorse collection.

8*d*.—Dorsal view of intermediate form, natural size. No. 3, Whitehorse collection.

8*e*.—Dorsal view of the type specimen, a cast, natural size. No. 1, Whitehorse collection.

8*f*.—Lateral view of 8*e*.

PLATE VIII.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3b
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PLATE VIII.

Naticella transversa. Page 171.

1, 1*a*.—Vertical and lateral views of a specimen enlarged about three diameters. From a squeeze. No. 6, Dozier collection.

Strophostylus permianus. Page 170.

2.—A large specimen, showing growth lines.

2*a*.—Another specimen, somewhat distorted, natural size. No. 71, Whitehorse collection.

2*b*.—Another compressed individual, enlarged. No. 72, Whitehorse collection.

2*c*.—Base of another specimen, showing aperture. No. 102, Whitehorse collection.

Trepospira haworthi. Page 166.

3.—Specimen showing approximate form of the apertures as shown in section of body whorl near the mouth of the shell, in the matrix. Enlarged. No. 59, Whitehorse collection.

3*a*.—Another individual, showing body whorl. Enlarged. No. 62, Whitehorse collection.

3*b*.—Outline of another specimen, showing spire. Enlarged. No. 63, Whitehorse collection.

Worthenopsis depressa. Page 164.

4.—Lateral view of specimen, natural size.

4*a*.—Nearly vertical view of the same. No. 45, Whitehorse collection.

Orthonema? texana. Page 168.

5.—Squeeze of specimen, showing general form of the shell. No. 1, Dozier collection.

5*a*.—Squeeze of a diagonal section of a mold which makes the shell appear too obtuse. No. 2, Dozier collection.

Murchisonia gouldii. Page 167.

6.—Lateral view of squeeze, enlarged about two and a half times. No. 14, Dozier collection.

6*a*.—Enlargement of same, showing surface marks.

6*b*.—Another individual.

Murchisonia collingsworthensis. Page 166.

7.—A detailed enlargement of the mold from which the squeeze shown in the following figure was taken.

7*a*.—View of squeeze, showing form of spire. No. 36, Dozier collection.

(OVER)

Orthonema dozierensis. Page 168.

8.—Lateral view of squeeze, ×5/1. No. 7, Dozier collection.

Pleurotomaria capertoni. Page 163.

9.—Squeeze of type. No. 5, Dozier collection.

9*a*, 9*b*.—Two specimens of this species from Whitehorse sandstone.

9*c*.—Basal view of 9*a*, showing closed(?) umbilicus. Nos. 77, 78, Dozier collection.

10, 10*a*.—Two specimens possibly belonging to this species, but probably distinct. The latter is somewhat distorted. Nos. 22, 23, respectively, Dozier collection.

Bulimorpha? alvaensis. Page 169.

11.—Side view of cast, natural size. No. 64, Whitehorse collection.

Capulus? haworthi. Page 169.

12, 12*a*, 12*b*.—Outlines of an apical and two lateral views. Two specimens. Nos. 31, 32, respectively, Dozier collection.

Worthenopsis sp. Page 165.

13.—Drawing of a squeeze, enlarged. No. 39, Dozier collection.

Pleurotomaria agnostica. Page 164.

13*a*, 13*b*.—Two casts, poorly preserved, enlarged. Nos. 73, 65, Whitehorse collection.

Loxonema permiana. Page 167.

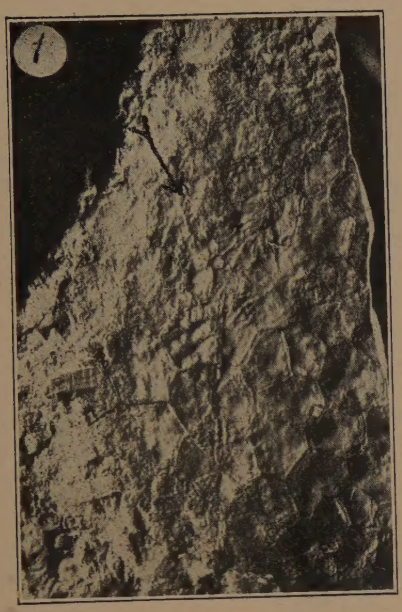
14.—Mold of specimen, ×19/2. No. 12, Dozier collection.

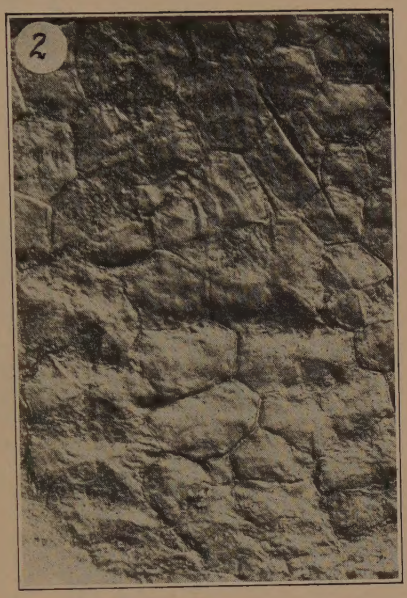
14*a*.—A section of a mold, somewhat diagonal, of another specimen. No. 13, Dozier collection.

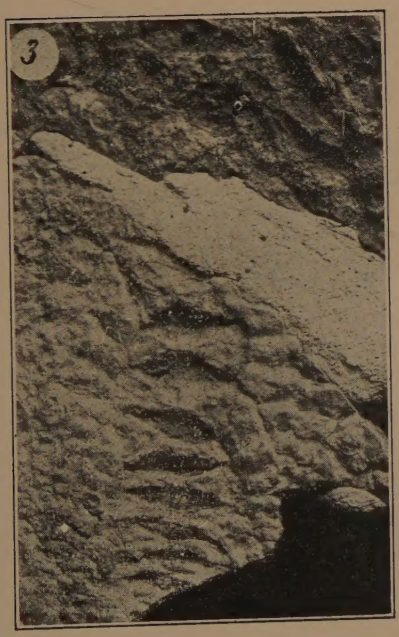
Pleurotomaria sp.

15.—Basal view of cast, showing a sheet of matrix extending into the umbilicus, demonstrating the existence of an umbilical slit. This species is probably generically distinct from No. 9*c* on this plate. Unfortunately this specimen was dropped and the matrix broken out after the drawing was made. No. 66, Whitehorse collection.

PLATE IX.







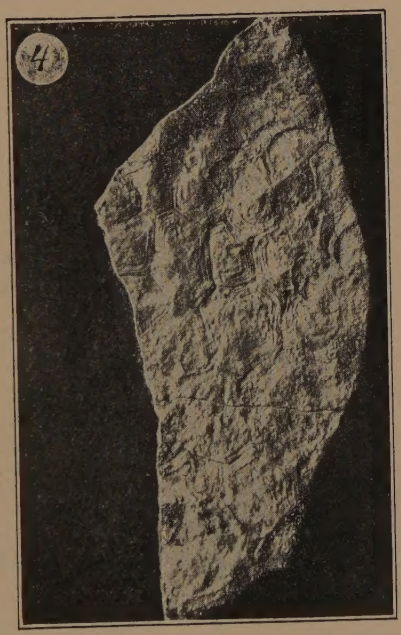
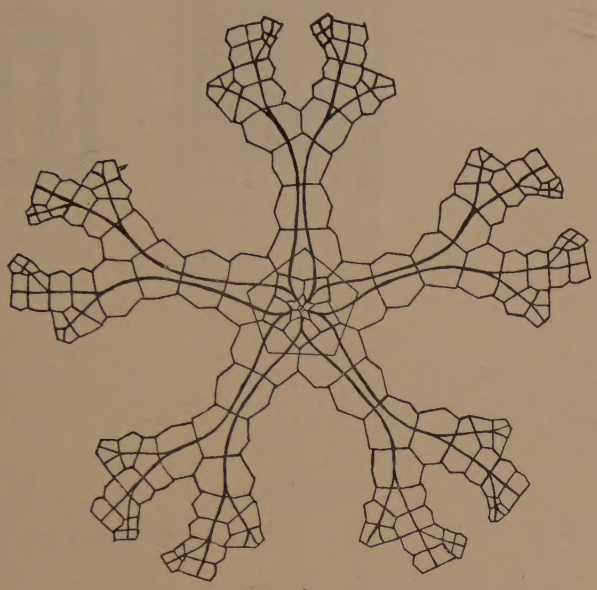
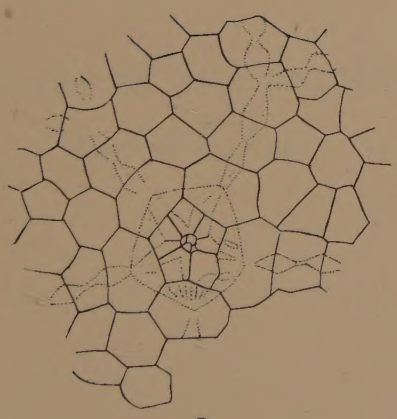


PLATE X.



1.



2.